



Presumed extinct *Dipcadi reidii* (Asparagaceae) recollected after 127 years from Uttarakhand, India

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Abstract

Dipcadi reidii Deb & S. Dasgupta was presumed extinct species in Red Data Book of Indian Plants and other literature that followed. A botanical exploration to its type locality at Malipa, Kali valley, Eastern Kumaon (Uttarakhand) during July, 2013 resulted in its recollection after a lapse of 127 years.

Keywords: *Dipcadi reidii*, type locality, Malipa, Kali valley, presumed extinct, endemic

Introduction

Dipcadi Medik. is represented by 41 species in the world with India as one of the centre of diversity having 10 species (The Plant List 2013; Prabhugaonkar *et al.*, 2009). Initially this genus was placed in Liliaceae, later in Hyacinthaceae and recent phylogenetic synthesis of Angiosperms available as APweb (Stevens, 2001) and The Plant List 2013 places it now in Asparagaceae (*sensu lato*).

With the publication of Red Data Book of Indian Plants six species of *Dipcadi* were assessed as threatened in India and thus prioritised for conservation (Dasgupta & Deb, 1987, 1988). Later this genus was also mentioned as a disappearing genus in India (Rawat, 2009a). Among these threatened species *D. concanense* (Dalz.) Baker and *D. reidii* Deb & S. Dasgupta were presumed *extinct* on account of lack of collection after type collection in 1861 and 1886, respectively (Dasgupta & Deb, 1987, 1988). Later, *D. concanense* was rediscovered and assessed as Critically Endangered (Mishra & Singh, 2001).

An exclusively Himalayan species, *D. reidii* was described by Deb & Dasgupta (1978) on the basis of a specimen collected by J.R. Reid in 1886 and housed at Herbarium of Royal Botanic Garden Edinburgh (E). After the type collection in 1886 the species was never reported from anywhere in the world leading to its status as *presumed extinct* (Dasgupta & Deb, 1987, 1988) and *extinct* (Rao *et al.*, 2003). But in the remote high Himalayan terrain it is extremely difficult to state authoritatively

that a species has become extinct from nature as evidenced by the recent rediscoveries of *Gentiana infelix* C.B. Clarke after 150 years, *Gentiana tetraptera* Biswas after 123 years, and *Arenaria curvifolia* Majumdar (Caryophyllaceae) after 121 years from Uttarakhand (Rawat, 2009b; Rawat & Gaur, 1996; Rawat & Rana, 2007). Though type specimen of *D. reidii* was collected by J.R. Reid from Uttarakhand in 1886, Deb and Dasgupta (1978, 1981) indicated its type locality in Himachal Pradesh. Dasgupta and Deb (1987) and Karthikeyan *et al.* (1989) repeated and even amplified the error by stating type locality as "Western Himalaya (without precise locality)" and "N.W. Himalaya", respectively.

In fact, J.R. Reid explored only British Garhwal, North Kumaon and Western Nepal with J.F. Duthie in 1886 (Duthie, 1906). Obviously the *locus classicus* (type locality) lies at or closer to Malpa (also written as Malipa), a location in Kailash - Mansarovar (Tibet) pilgrimage via Lipulekh Pass in upper Kali valley of Northeast Kumaon. The area of Kuttii - Yangti (a tributary of Kali river) and upper Kali valley is also known as 'Byans Valley' (hence the word 'Byaus Wells' on type specimen) and lies adjacent to Tibet and Nepal (Rawat, 2005). It is almost certain that the remote type locality has not been re-explored and even if it is, the plant can be narrowly missed by a margin of few weeks (flowering period in the species is short), or by few feet during general plant collection in the Himalaya due to abrupt changes in the habitat and (thus) in the species composition within few feet.

After determining the correct type locality of *Dipcadi reidii*, authors conducted a intensive botanical exploration in and around exact type locality (Malipa) on the exact date of type collection (16th July). During this exploration about 25 km on foot trekking was done in and around type locality. This endeavour resulted in collection of a species of *Dipcadi* which was ultimately determined as *D. reidii* Deb & Dasgupta after thorough checking of protologue of species (Deb & Dasgupta, 1978), other relevant literature (Deb & Dasgupta, 1981; Dasgupta & Deb, 1987) and comparison with digital image of holotype available on two web resources Encyclopaedia of Life (<http://eol.org>) and JSTORE Plant Science (<http://plants.jstor.org>).

This species was recorded on vertical to very steep moss laden moist rocks associated with mosses, *Selaginella* sp. and few grasses between Bindrakoti and Malipa area in an altitude range of 1890–2200 m.a.s.l. (based on Google Earth) in the area. Considering the extremely threatened status of species, four specimens with bulbs were collected. The properly processed voucher herbarium specimens are deposited in Herbarium of G.B. Pant University of Agriculture and Technology Pantnagar, Uttarakhand (GBPUH).

The available taxonomic description of the species is based on only two herbarium specimens housed at Royal Botanic Garden, Edinburgh. Since range of variations observed in natural populations are not reflected in the protologue a detailed description of this species is provided below:

Dipcadi reidii Deb & S. Dasgupta, J. Bombay Nat. Hist. Soc. 75: 69. 1978, Fasc. Fl. India 7: 5-9. 1981; Karthik. et al., Fl. Ind. Enum. Monocot. 93. 1989; Uniyal et al., Fl. Pl. Uttarakhand 239. 2007.

Type: INDIA, Malphagarh, Byaus Wells above Kali valley, 2300 m, 16th July, 1886, J.R. Reid s.n. (Holotype, Isotype E)

Fig. 1a-b, d-g

Perennial, bulbous, scapigerous, glabrous herbs. Bulbs white, tunicated, shining, ovoid or rounded, 2–4 × 1.5–3 cm, disc rounded. Leaves all basal, 3 or 4, prostrate over ground or hanging downward, shining green, 40–100 × 1.0–1.7 cm, usually longer than flowering axis, linear, broader in lower half, acute, glabrous, little fleshy when fresh, becoming membranous in herbarium specimens, veins many, up to 20. Scapes glabrous, rounded, green, solid when fresh, terete in herbarium specimens, tough, 20–40 × 0.3–0.4 cm in flowering, elongating to 80 cm or more in fruiting, bearing flowers only in upper half. Inflorescence a raceme, 5–25

cm long, compact in bud stage, loose in flowers, up to 28 flowers. Bracts membranous, white, triangular, acuminate, 6–13 × 5–9 mm, persistent, smaller to longer than pedicel, glabrous, many nerved in lower half. Pedicel up to 1.0 × 0.1 cm in flowering, in fruit elongating to 2.0 cm, glabrous, erect in buds and fruits, curved outward in flower. Flowers campanulate, 1.5–1.9 cm long, 1.5–1.8 cm across, white with pinkish-brown band on outer side of perianth which is narrower in inner three tepals. Perianth sub equal, united up to 0.5–0.6 cm from base forming tube, free above, lobes oblong, rounded, thickened along veins, outer three spreading in upper ⅓ part, cucullate or hooded at apex, with 5 parallel veins in middle, inner three tepals cohering (not fused) to each other up to ⅓ part, curved outward in upper ¼ part, oblong, rounded. Stamens 6, antitepalous, included, originating from the mouth of perianth tube below, filaments strap-shaped, thin, membranous, linear, not attenuated at apex, little wider at base, one veined; anthers dithecos, dorsifixed, oblong, 4–4.5 × 1–1.5 mm, introrse, greenish. Ovary with less than 1 mm long stipe, 5–6 × 3 mm, trisulcate, pinkish, oblong, glabrous, trilocular, each locule with many ovules in axile placentation; style terminal, up to 7 mm long (including stigma), linear, papillate in upper half, stigmatic lobes 3, densely papillate, cohering to each other, 1 mm long. Fruit a capsule, brownish, shortly stipitate, 12 × 12 mm, with 3 distinct lobes parallel from base to apex, glabrous, with 10–12 seeds in each locule, transversely striated with 6–9 nerves, opening apically. Seeds flat, thin, light, rounded, black, 5–6 × 0.5 mm, stacked.

Flowering & Fruiting: July – August

Specimens examined: INDIA, Uttarakhand, Pithoragarh District, Rocks near Malphagarh in Kali Valley, 7–8000', 16.07.1886, J.F. Duthie 6028 (DD!); Kali Valley, on steep rocky slopes above old Malipa village, 2100m, 17.07.2014, D.S. Rawat & Satish Chandra, Acc. No-620/7.10.2013; 2 kms ahead of Bindrakoti towards Malipa, Kali Valley, in wet rock crevices, 2100 m, 16.07.2014, D.S. Rawat & Satish Chandra, Acc. No- 618/7.10.2013 (G.B. Pant University Herbarium!).

Distribution and Ecology: Distribution of this species indicates that it is a narrow endemic restricted to <15 km² in Bindrakoti-Malipa area in gorge of Kali River with narrow altitudinal range from 1890 to 2200 m.a.s.l. Possibility of its occurrence on other side of Kali River (in Nepal) cannot be ruled out due to similar habitats and close proximity (Fig.1c). Five scattered populations of this species



Fig. 1. *Dipcadi reidii* Deb & S. Dasgupta: **a.** Habit; **b.** Leaves and inflorescence; **c.** Upper Kali valley where species was recollected, Kali river makes India-Nepal boundary and Kailash-Mansarovar track is visible on Indian side (left side); **d.** A portion of leaf showing width; **e.** Flowers; **f.** Bulbs; **g.** Fruits and seeds.

were noticed in the area of occurrence. All the individuals seen in the area were found infected with unknown leaf blotch fungus which distorts and dries the upper part of the leaves. As per IUCN categories of threat it may be categorised as *Critically Endangered* (B1a, B2a) and following Dhar (2002) this species falls in 7th cell (restricted geographical range, narrow ecological amplitude and low anthropogenic pressure) in the 1 to 8 cell scale proposed for prioritized conservation of endemic species.

This recollection of *D. reidii* shows that it is an extant and surviving species in wild habitats in Uttarakhand. Since the species is very habitat specific and narrow endemic, localized to a very small area of less than 15 km² in disaster prone Himalayan terrain its rehabilitation in similar habitats in protected areas, study of reproductive behaviour and development of micro-propagation protocol for multiplication is urgently suggested for its future survival in changing climate.

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